PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference PE-0787	**FOR FURTHER ACTION**	See Form PCT/IPEA/416
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Applicant
SPA - SOCIEDADE PRODUTORA ALIMENTICIA LTDA. et al

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 6 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 28 sheets, as follows:
      ☐ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☒ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the report
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☐	Box No. VIII	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
12.12.2005	07.06.2006

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/BR2004/000111

Box No. I Basis of the report

1. With regard to the **language**, this report is based on

   ☒ the international application in the language in which it was filed

   ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3(a) and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4(a))
   - ☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a))

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages

1	as originally filed
2-19	received on 28.12.2005 with letter of 12.12.2005

Claims, Numbers

1-12	received on 28.12.2005 with letter of 12.12.2005

Drawings, Sheets

1-6	received on 28.12.2005 with letter of 12.12.2005

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☒ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   - ☒ the description, pages 11-19
   - ☒ the claims, Nos. 1,9-12
   - ☒ the drawings, sheets/figs 3-6
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

* *If item 4 applies, some or all of these sheets may be marked "superseded."*

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-12
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-12
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-12
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item I
Basis of the report

1. The amendments filed with the letter dated 12.12.05 introduce subject-matter which extends beyond the content of the application as filed, contrary to Article 34(2)(b) PCT.

The amendments concerned are the following:

i) "process ... utilising a batch system cycle process operation" (claims 1, 10)
ii) "spectral range finesse [of the pre-ground dry raw material ingredients]" (claim 1)
iii) "unrefined raw material ingredients (claim 1)
iv) "the formulation ingredients still in their ... unrefined initial stage (claim 1)
v) "articulated paddle agitator arms" (claims 1. 11)
vi) "fixed filtered air injection paddle arms" (claims 1, 11)
vii) "special shearing" (claim 1)
viii) "dry mass with a consistency of a plastic powder" (claim 1)
ix) "insufflation of filtered cold air" (claim 2)
x) "horizontal closed refining roller ball mill" (claim 2)
xi) "water jacket wall refrigeration system" (claim 2)
xii) "final finesse [of the refined chocolate mass]" (claim 1)
xiii) "chocolate mass thickness of *about* 20-40 microns" (claim 9)
xiv) "*special* U-shaped conch" (claim 10)
xv) "filtered pre-heated air" (claim 10)
xvi) Figures 3-6 and the corresponding parts of the description on pages 11-19 and the references to these drawings in claims 1 and 9-12).

Re Item V
Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Reference is made to the following documents :

D1: US-A-3663231
D2: US-A-6129008

D3: DE-A-3202929
D4: US-A-5676995
D5: US-A-4440797

2. Novelty (Article 33(2) PCT)

2.1 D1, considered to be the closest prior art, discloses (cf. Figure 2) a chocoloate processing method in which pre-treated chocolate mass is wet conched in a U-shaped conch. Rotary arms are used to process the mass in the conch.

The subject-matter of claim 1 therefore differs from D1 in that ground raw materials are added directly to the conch for dry conching followed by wet conching, using a combination of rotary and fixed arms and using cold air blown into the conch for cooling following wet conching, followed by a grinding step in a ball mill.

Additionally, with respect to independent claim 10, D1 does not disclose a means for blowing cold air into the conch.

Furthermore, with respect to independent claim 12, D1 does not disclose a sugar mill or cocoa refining mill connected or adjacent to the conch.

None of D2-D5 disclose a U-shaped conch.

The subject-matter of claims 1-12 is therefore novel.

3. Inventive Step (Article 33(3) PCT)

3.1 The problem to be solved by the present invention may be regarded as the need to provide a conching method for chocolate which is suitable for batch processing on a relatively small scale for economic reasons.

None of the prior art addresses this problem; D1 in particular is concerned with a continuous conching method, generally intended for large scale chocolate processing.

The subject-matter of claim 1 is therefore inventive.

The same reasoning can be applied to the subject-matter of independent claims 10 and 12.

to 50 microns was obtained, which is unacceptable by the current standards that oscillates in the range of 16 to 25 microns), thus producing the basic mass for the manufacturing of chocolate topping.

Subsequently, the duly grounded mass (50 to 40 microns) was added to an equipment denominated "arm conch for the processing of chocolate" (such equipment is currently outdated since it does not perform the correct chocolate processing execution and does not meet the ongoing required standards in the market).

The conch had a self-heating container and eccentric arms which were mechanically articulated by a camshaft which provided an alternative movement to a heavy steel roll fixed to its end. The chocolate mass, already in its liquid form (with the remaining of the cocoa butter of the added formulation), was kept therein under constant agitation for as long as twenty four to seventy two hours in order to reach the development of a full flavor of the chocolate topping (this processing period is not acceptable by the current chocolate topping processing industries).

The evolution of the machine manufacturing industry throughout the twentieth century has enabled the modernization of the original processing equipment for the manufacturing of chocolate and brought about the first significant alteration that sought higher efficiency in the processing work, besides the improvement of its qualitative characteristics.

Thus, the process carried out in the past by the "melageur"

(mix/grinder with granite rolls) was substituted by the efficient work performed in the mass by a rotating arms sigma type mixer, which was followed by the addition of a new equipment denominated "cylinder mill", known as "chocolate refining".

Such alteration has enabled higher efficiency in the productive processing of chocolate topping as well as the improved homogenization of the mass mix which will make future grindings easier by the "chocolate refining machine" (rolling mill). This will make a substantial improvement in the thickness patterns of the chocolate topping (16 to 20 microns in the current thickness patterns), reaching higher industrial performance and productivity in the organoleptic qualities of the final product.

Throughout the twentieth century, several conch models have come up seeking to improve the work performed by the outdated alternative arms "chocolate processing conch" (cycle of 72 hours).

The equipment placed in the market by the industry of equipments for the manufacture of chocolate topping are characterized by producing higher mechanical work through its mechanical arms. In this way, high power motors have been installed to move the mechanical arms acting with their slow mixers that constantly revolve the chocolate mass topping. The latter can cause high friction to the chocolate mass topping, which processing characteristic is fundamental for developing the final correct flavor of the chocolate topping.

The upcoming of more powerful machines into the market has

enabled a basic chocolate processing change during the "conching" process (as compared to the previous used alternative arms conch). The great innovation was the division of the chocolate mass topping conching, which was performed only during the liquid phase (with all the cocoa butter of the added formula), into two new distinct phases. The first one known as "dry conching" (where only part of the butter in the formulation of chocolate topping is added to the mix, thus enabling a dry mass with the adding of the flour) followed by the "humid conching" (where the remaining of the cocoa butter in the formula will be added to liquefy the topping mass with a consistency of a very viscous liquid).

With the upcoming of the possibility to use the above described equipments (mixer, chocolate refining and chocolate conch) the current process used by the chocolate manufacturing industry is characterized by the following:

The ground sugar in hammer mills (180 microns thickness) is added together with the other ingredients of the formula, namely, cocoa mass, part of the cocoa butter in the final formula and eventually powder milk (in the case of chocolate milk), into the recipient of the rotating arms horizontal mixer. The chocolate topping mass ingredients are then mixed, heated at 40°C and homogenized, until they acquire a firm and sticky mass consistency.

In the subsequent steps, the chocolate topping mass grinding (refining) is carried out (only with part of the total butter in the formula, around 24% of the total fat in the formula) using the "five cylinders

refining" machine (thickness obtained of 16 to 25 microns). The mixture leaves this machine as a thin powder which already has its final thickness characteristics (temperature of 45°C).

Thereafter, the powder (16 to 25 microns) coming from the chocolate mass refining is added to the equipment recipient denominated "chocolate conch", in which it will receive the treatment for developing the characteristic flavor of the chocolate topping. This is the last processing stage and it is divided into two phases: "dry conching" and "wet conching."

In the first phase, where the mass has the consistency of flour (24% of total fat), the mass undergoes a strong mechanical work through the stirring arms of the "chocolate processing conch", usually two to six arms, with the basic purpose to develop the chocolate topping scent and flavor, besides improving its viscous characteristics for the partial elimination of the humidity retained in the chocolate topping mass (amounts computed from 1 to 0,5% moisture). Such viscous characteristic is fundamental to enable a good mass workability for the topping of bonbons and chocolate candies (the ideal viscosity is 300,000 to 340,000 Pa.s).

The removal of the humidity is carried out through heat generation caused by the strong friction of the mechanical arms of the conch which provides a strong heating to the mass (maximum temperature of 60°C which should be respected due to the crystallization of the ground sugar thus generating clots in the product).

Such mechanical arms, which are rotating at a low speed, execute a movement that seek to insert a certain quantity of fresh air in the interior of the dry chocolate mass with the purpose to oxidize the tannin, anthocyanin and the remaining acetic acid wastes from the cocoa almonds fermentation, which are responsible for the product astringency and acid characteristics. At this stage, the product is subject to constant agitation, at low speed, under controlled temperature, which should not exceed much more than 60°C, otherwise it will occur the risk of re-crystallization of the refined sugar, thus making product futile when hard clots are formed for losing its essential thickness feature. At this stage, the chocolate mass topping is processed in periods of 12 to 16 hours, after which the remaining of the formulation butter will be added therein (thus completing 30% to 36% of the fat content which is normally found in the chocolate toppings) and thoroughly liquefying the chocolate mass topping and starting what is characterized as the "wet conching" in periods of 6 to 12 hours, and completing a total average processing of 24 hours per processing batch.

The chocolate mass will remain in this processing phase under constant agitation, with the mechanical arms moving at high speed to undo the dry mass in the remaining of the added butter under the controlled temperature (60°C).

The present invention is based on the use of auxiliary equipments with high operational performance rate associated to a unique processing methodology, thus obtaining low energy consumption, operational cycle and processing installation cost vis-à-vis the produced chocolate volume, upon comparing same to more recent and modern

chocolate processing techniques. This is only possible due to the use of a "U" type shape conch for processing chocolate, which is also the object of the current invention. The chemical and organoleptic characteristics are kept if the most modern conventional chocolate processing is used.

The purpose of the present invention is to improve the current chocolate topping manufacturing with low fixed assets and installation equipment when comparing to the conventional equipment costs used for such purpose, by using a new equipment ("U" type shape chocolate conch), especially developed as a support for this new processing form during the important step of the chocolate manufacturing process known as "(wet and dry) conching chocolate topping mass".

As a result of the use of this technology, a new processing compact unit may be used, occupying a small physical area in the plant complex (upon comparing to an area at least three times bigger of a conventional plant) and with a low operational cost with regards to the used power versus the produced chocolate topping ton and labor directly involved in the productive processing.

This will also enable the achievement of an expressive improvement in the overall time of "conching processing" of the chocolate mass topping flavor and final viseosity, if they are used in the bonbons filling and general candies, where the product fluidity is necessary.

The manufacturing process herein used for the chocolate topping manufacturing, which is the purpose of this invention, intends to

establish a system characterized by:

- Low fixed assets equipments cost and auxiliary components, when compared to a production volume equal to the current manufacturing processes equivalent to those performed by equipments and conventional processes. Therefore small and medium companies may also make capital expenditures for the manufacturing of their own chocolate topping. This possibility was remote due to the high conventional installation cost vis-à-vis the companies' production scale;
- Low cost and operational simplicity, which make feasible the direct operational labor cost, even for small production scales, thus making competitive in costs the chocolate produced in the processing unit of present invention, even for small production scale in both small and medium companies;
- The installed electric power significantly lower (50% lower), when compared to conventional manufacturing chocolate plants that produce chocolate with the same quality. The result will be a low cost of installation and electric power consumption, vis-à-vis the chocolate volume produced under this invention for similar volumes of chocolate produced through conventional means;
- Smaller physical area for the production equipments installation (30% of installed area for a conventional plant of the same capacity) if it is compared to chocolate

topping plants that have the same chocolate topping quality and the same volume produced;

- Operational simplicity characterized by the linear productive processing system, which enables a high automation level for the processing stages with low capital spending and medium level labor qualification without jeopardizing final product quality.

The present invention comprises a new process procedure optimized steps and compact design of the current chocolate mass manufacturing technology with alternative resources for an intensive processing; besides the use of equipment and auxiliary equipment which are specifically developed for this purpose and that are integral parts of this invention. It is also provided a low reduced operational time at low operational cost to the system user, when compared to the used conventional processes for the same purpose.

The raw material to be used, namely, cocoa mass and butter, sugar, powder milk, is received in its dry original form and as provided by the respective manufacturer (such ingredients are an integral part of the chocolate mass formulation). It is added into the dry pre-grinding system that follows by mechanized transportation to the "U" type shape conch for intensive-dry conching shearing chocolate processing, which was especially developed for this new processing design. The raw material will then undergo (in its dry form) an intensive dry conching treatment during a pre-determined time (4 to 8 hours).

The already liquefied chocolate mass is subjected to a wet conching treatment and then transported through a positive displacement pump to a closed rolling ball mill where it will undergo final rolling and miling treatment to reach the thickness and finesse as specified by the market (20-40 microns), and it will follow through a tube to the stock tank where the chocolate mass (in its liquid form) will await until it is solid after the final processing.

The invention's purpose is to improve and facilitate the chocolate manufacturing process, without however disregarding important processing stages already known, such as "chocolate mass conching"(dry and wet).

The invention is based on the fact that the complex interactions that occur among the sugars, proteins, and amino acids, which in their turn comprise the preceding chocolate flavor and scent characteristics during the dry and wet conching chocolate mass processing, follow well defined and known procedural parameters, but that nonetheless are not optimized in the industrial practice.

In order to achieve the proposed purpose it is necessary to use an intensive "U" type shape conching treatment, where through a very special configuration, it will enable that the above mentioned chemical reactions will occur in a period of time shorter than that provided by the current existing conventional processing systems.

As a benefit arising from this invention, it may also be

mentioned the possibility to configure a compact processing steps and an apparatus to do it that will require a small physical area in the plant complex (where in a conventional plant it would be necessary an area at least three times larger, with much more complex operations steps). In addition, it would have a low operational cost with regards to the power used vis-à-vis the produced chocolate topping per ton. This should also optimize the direct "labor" involved in the productive processing.

As additional benefit, it should be achieved an expressive improvement of the overall "conching" (processing) time of chocolate topping mass, of its flavor and of its final viscosity. This will enable better product workability if it is to be used in the topping of bonbons fillings and candies, in general, where higher product fluidity is always necessary.

The invention described hereunder with regard to the attached drawings shows that:

Figure 1, 3 and 4 show a chocolate manufacturing system flow chart in accordance with the present invention.

Figure 2 shows a schematic outlook view of the conch in accordance with the present invention.

Figures 5 and 6 show a chocolate manufacturing compact system layout configuration.

Example of the implementation of the invention:

Operational characteristics procedure using chocolate mass processing technology in the "U" type shape conch **9** for intensive dry and wet conching of chocolate mass process.

First Stage: Pre-grinding

This processing starts with the pre-grinding of the crystal sugar and the powder milk (when it is the case of chocolate milk), using a dynamic impact mill **4** of the type of rotor and stator and calibrating sieve, which will be operating with a rotation between 3,000 to 9,000 rpm and will use a sieve with drilling holes diameters varying from 0.5 to 3.0 mm. As a result, a sugar ground power of 10 to 200 microns thickness range will be achieved with physical characteristics of final ground sugar particles dimensions that are within the above mentioned range.

Second Stage: Dry and wet conching

The product (the mixing of pre-ground sugar and powder milk) with the above mentioned characteristics (thickness between 20 and 200 micra) moves forward through an adequate transporting thread type transportation system to "U" type conch **9, 27** for intensive shearing ~~choc~~olate conching ~~proeess.~~ ~~This~~ system ~~was~~ especially developed to perform this processing stage, and that is also the purpose of this invention the U-shaped conch member specially designed to work with the articulated paddle arms **11** which turns the chocolate mass in a dynamic round movement against the fixed paddle arms **10** during the dry and wet

conching process operation. At the end of the dry conching stage, it is added part of the liquid ingredients of the formulation, namely, butter and mass cocoa, which have been previously melted and heated at 50°C through the heat water cycling in the water-jacketed bed of "U" type shape conch **9, 27** for intensive wet conching chocolate treatment.

The formulation ingredients still in its initial unrefined pre-grinding stage are homogenized through the alternate movement of the agitator arms of the "U" type shape conch **9, 27** for intensive treatment, thus forming a dry mass with a powder consistency due to a special dinamic rotative movement. In this stage, it is started the chocolate mass processing cycle denominated "dry conching" and it is provided the chemical interaction of sugar and proteins of the raw materials which develop the chocolate flavor.

The "U" type shape conch **9,27** for chocolate intensive conching process, with the processing capacity that varies from 150kg to 10.0t capacity, which means conch process chamber batch capacity, is activated by a driving power that varies from 3hp up to 100hp respectively, due to the processing capacity. In its conception, it has been developed a special shape configured fixed arm paddle **10** and articulated paddle arms arms **11** revolving and agitator system with the purpose to increase the shearing work into the chocolate dry mass and the exposition of the chocolate mass cycle mixture to the filtered **35** pre heated air **13** coming trough the injection tubes fixed at fix paddle arms **10** from the performed forced ventilation through a high pressure fan **14**, flow and air pressure of which that vary from 2.0 m^3/h to 10.0 m^3/h and 600 to 400 mm water

column respectively, and it is activated by an electric motor with power that varies from 3.0 to 5.0 hp (depending on the conch capacity). It also has a heating electric resistance **13** with power that varies in the range of 2,000 to 5,000 kW (depending on the fan used in the conch).

In the "dry conching" process step, the chocolate pre-grinded mass is submitted to an intense mechanical work by the agitator articulated paddle arms **11** of the "U" type shape conch **9, 27** for intensive chocolate processing, providing a temperature increase due to the shearing friction among the raw materials particles thus increasing the chocolate mass temperature that will vary among 60 to 90°C. With this work it is obtained the elimination of part of the humidity of 0.1 to 0.8% contained in the raw material ingredients mass.

In this process the steam evaporation through the streaming dragging effect will cause the carrying of a series of undesirable components and flavors that were originally in the cocoa mass. Such components and off flavors that remained in the cocoa seeds fermentation and processing interfere negatively in the chocolate mass final flavor. This processing step is done by the specially designed air injection device **10** wich mixes the filtered **35** heated **13** air inside the mass during the dry and wet chocolate conching process.

The exposition effect of this chocolate mass to the air oxidation action is intensified with the hot air **13** injection device **10** coming from the high pressure fan **14** with the purpose of oxidizing the acids remaining from the cocoa fermentation process, the largest

concentration being of acetic acid, which also oxidizes the tannins and anthocyanins which are the cocoa natural coloring that give to the chocolate mass flavor a strong astringent dose.

The processing characteristics in the "U" shape type conch **9,27** for intensive chocolate processing during the dry conching stage are intensified using a maximum exposition cycle of the chocolate dry mass to the hot air **13**, which needs a six hours exposition per operation batch, regardless of the conch capacity which uses 50% of the power used in the conventional and classical conching process.

Third Stage: liquefaction and cooling

In this state, the chocolate mass receives the remaining of the cocoa butter from the formulation through pump **17**. It is then homogenized by the alternate movement of the special articulated agitator paddle arms of the "U" type shape conch **9, 27** for intensive chocolate wet conching process operation. It will assume the pasty liquid form and thereafter it is cooled by a cold water injection cycling in the "U" type shape conch **9, 27** water jacket wall, for intensive chocolate processing work and by the filtered **35** cold air insufflation provided by the high pressure fan **14** until the chocolate mass temperature reaches 39°C.

Fourth Stage: Chocolate Mass final grinding

The product (chocolate mass) in its liquid form is transferred through the positive displacement pump **23** to a closed refining rolling ball

mill **21** of chocolate mass with grinding pot capacity that varies from 10 to 500 liters and activating power that varies from 7.5 to 200 hp and flow rate from 100 to 2,500 liters respectively. The close rolling refining ball mill is provided with a cooling system of water jacket, with the purpose to keep the chocolate mass temperature that cycles in its interior submitted to a shearing friction power caused by the rolling eccentric movement and that turn at high rotation (700 rpm) at the temperature of 60°C. The chocolate mass already refined (20-40 microns) is transported from the horizontal closed refining roller ball mill **21** to the stock tank **24** through pump **23**, where in its final use state will wait for the adequate solidification moment.

Next, it is shown a flow chart description using a chocolate mass processing technology in a compact plant complex and a "U" type shape conch **9, 27** for intensive dry and wet chocolate conching process operation.

As an example, fifty kilos sugar bags will be added to the sugar mill hopper **1** that has a vibrating feed channel **2** that feeds the cup lift **3** and that will further supply the sugar mill of the "turbomill" type **4**. The ground sugar is deposited by gravity in the interior of a motorized stock bin **5** provided with scraper arms **6**, where it is fully unloaded.

The amount of ground sugar deposited in the bin is exactly the fraction corresponding to the chocolate formulation that is intended to be manufactured and is reserved while it waits for the right moment to be unloaded in the "U" type shape conch **9** for intensive dry and wet chocolate conching process operation. The integral powder or skimmed milk comes

from the formulation which is normally received in multifoliate bags, each containing twenty five kilos and that is also added to the mill hopper **1**. It moves forward through the mill feed cup lift **3** and through turbo mill type **4** and is deposited in the ground sugar stocking bin **5**, where it will wait the right moment for the dosing through the transporting thread **7** and **8** to the "U" type shape conch **9** for intensive chocolate processing. The cocoa butter provided in blocks with 25 kilos weight is added into the butter melter **16**, which has especially been developed for this purpose.

The cocoa butter deposited in the melter recipient **16** remains at the temperature of 50°C and is transferred through centrifuge pump **17** for the "U" type shape conch **9, 27** for intensive chocolate processing. The cocoa mass, which is normally supplied in pieces conditioned in multifoliate bags of 25 kg, is added to the cocoa mass automated melter **18**, which has been developed for this purpose.

The cocoa mass already in its pasty phase, kept at the temperature of 45°C, is transferred through a positive displacement pump **20** to the "U" type shape conch **9** for intensive dry and wet chocolate conching process operation. The next stage that is determinant in the chocolate mass manufacturing process is performed in the "U" type shape conch **9, 27** for dry and wet chocolate conching process operation.

The liquid ingredients, cocoa butter and cocoa mass that were reserved in the interior of the conch are heated at a temperature of 70°C. The dry ingredients, ground sugar and milk powder reserved in the stock automated bin **5** are transferred through transporting threads **7** and **8** to the

processing chamber of the "U" type shape conch **9, 27** for intensive chocolate processing , thus comprising partially the chocolate mass formula and providing for the mass formation with the consistency of a dry powder. In this stage (dry conching) the chocolate mass has a fat content of 16 to 20% of the chocolate mass final formulation.

The conch temperature control system will be adjusted to operate at the range of 60 to 80°C until the end of the process. During this stage that may take four to six hours, fan **14** and resistance **13** will be activated to inject filtered **35** heat air (70°C) into the interior of the chocolate mass by the injection device **10** depicted in Figures 1, 3, 4, 5 and 6, thus reaching an excellent performance in the extraction of humidity and of the undesirable volatile matter in the chocolate mass.

In the next stage, denominated liquefaction and refine, the remaining of the formulation butter stocked in the butter melter **16** will be transferred to the interior of the "U" type shape conch **9, 27** for intensive chocolate processing through pump **17** liquefying and homogenizing the chocolate mass, while it cools the mix at 45°C by using the water jacket system of the conch processing chamber, where at this phase the cold water process cycles.

The ~~liquefied~~ chocolate-mass is ~~trans~~ferred to closed refiner roller ball mill **22** through pump **23** to be ground. During this phase, the chocolate temperature is kept at 60°C through a cooling system provided by the cold water cycle in the mill water jacket wall.

The chocolate mass returns to the chamber of the "U" type shape conch **9, 27** for intensive wet chocolate conching process operation. The chocolate mass circulates through this equipment until it reaches the desired final finesse, and deviates thereafter to the stock tank **24** the finished liquid chocolate mass.

CLAIMS

1. Process for manufacturing chocolate mass utilizing a batch system cycle process operation, **characterized by** comprising the following steps:

a) dry pre-grinding of the raw material ingredients received in its original dry form until a desired spectral range finesse following through a mechanized transportation to the next stage;

b) dry conching of the pre-grinding or unrefined raw material ingredients product with the desired finesse characteristics in a "U" type shape conch (9, 27) for intensive chocolate dry conching process, in which part of the liquid ingredients of the formulation is added, after being previously melted and heated at an adequate temperature in such a way that the formulation ingredients still in their pre-grinding or unrefined initial stage are homogenized by the alternative movement of the articulated paddle agitator arms (11) against the fixed filtered air injection paddle arms (10) of the "U" type shape conch (9, 27) for intensive chocolate dry conching process, through a special shearing dynamic rotating friction movement, thus forming a dry mass with a consistency of a plastic powder;

c) liquefying and cooling and wet conching the chocolate mass, where it receives the remaining of the cocoa butter of its formulation, being homogenized by the alternative movement of the agitator articulated paddle arms (11) against the fixed filtered air

injection paddle arms (10) of the "U" type shape conch (9, 27) for intensive wet conching chocolate process, thus assuming a pasty liquid state, and thereafter, cooled through the injection of a refrigerating fluid that circulates in the water jacket of the "U" type shape conch (9, 27) for intensive chocolate wet conching process and by the insufflation of filtered (35) cold air provided (14) until the chocolate liquid mass reaches the desired temperature;

d) liquid chocolate mass final grinding, in which the chocolate mass in its liquid state is transferred to a chocolate mass horizontal closed refining roller ball mill (21) provided with a water jacket wall refrigeration system, with the purpose to keep the temperature of the chocolate mass, which circulates in its interior submitted to a friction power in the adequate value and in which the chocolate mass already refined with its final finesse is transported from the horizontal closed refining roller ball mill to a stock tank (24) and, in its final state of use, waits for the adequate solidification moment.

2. Process in accordance with claim 1, **characterized in that** the raw material consists of cocoa mass and butter, sugar and milk powder.

3. Process in accordance with claim 1, **characterized in that** the ground material of step a) is 10 to 200 microns finesse.

4. Process in accordance with claim 1, **characterized in that** the temperature in which the melted ingredients have been heated in

the step b) is about 50°C.

5. Process in accordance with claim 1, **characterized in that** the temperature of the chocolate mass is increased to 60-90°C in the step b).

6. Process in accordance with claim 1, **characterized in that** the cooling fluid in step c) is water.

7. Process in accordance with claim 1, **characterized in that** the desired temperature of the chocolate mass in step c) is about 39°C.

8. Process in accordance with claim 1, **characterized in that** the chocolate mass temperature in step d) is about 60°C.

9. Process in accordance with claim 1, **characterized in that** the chocolate mass thickness in step d) is about 20-40 microns.

10. Machine for the chocolate mass batch cycle processing, **characterized by** comprising a structure made of a special U type shape conch (9, 27), an agitator axis (12) in which a fixed special dynamic design articulated paddle arms (11) and fixed paddle arms air injection agitator fixed in the conch chamber structure (10) where the articulated paddle arms agitator (11) work against the fixed paddle arms air injection agitator (10) for increasing the chocolate dry mass exposition cycle to the filtered (35) pre-heated (13) air coming from a forced ventilation performed through a high pressure fan (14), activated by an electric motor with a heating electric resistance (13).

11. Machine in accordance with claim 10, **characterized in that** the U type shape conch (9, 27) has jacketed walls to receive a refrigeration fluid.

12. Compact installation for the chocolate mass processing, **characterized by** comprising a disposition of germinated equipments where a sugar mill (4) is located above the U type shape conch (9, 27) thus making feasible the direct dry grinding of the ingredients in the U type shape processing conch followed by the junction of the cocoa refining mill (21) in the side of the U type shape conch structure thus forming a monolithic block of equipments occupying an extremely reduced physical area.

FIG. 1

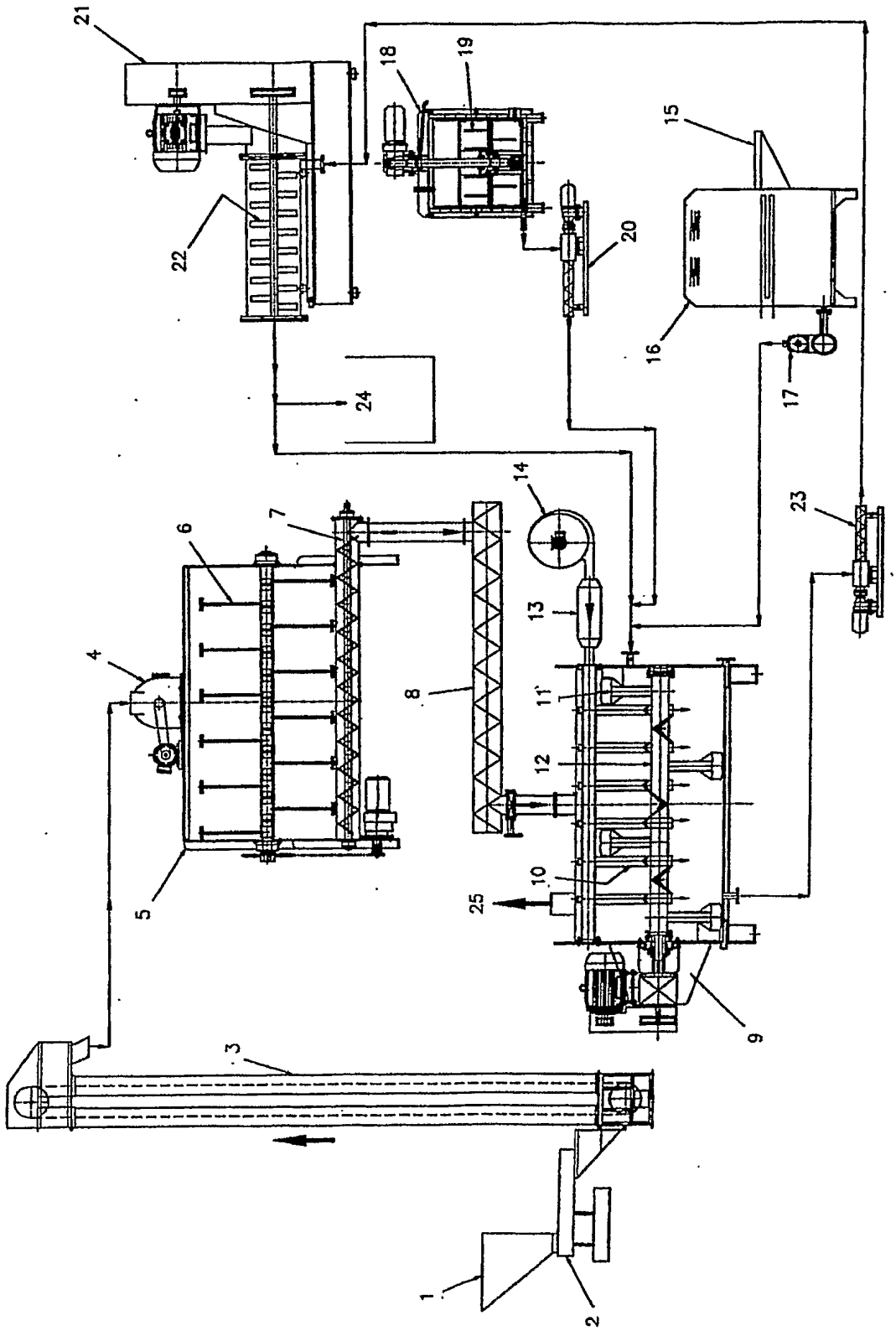

FIG. 2

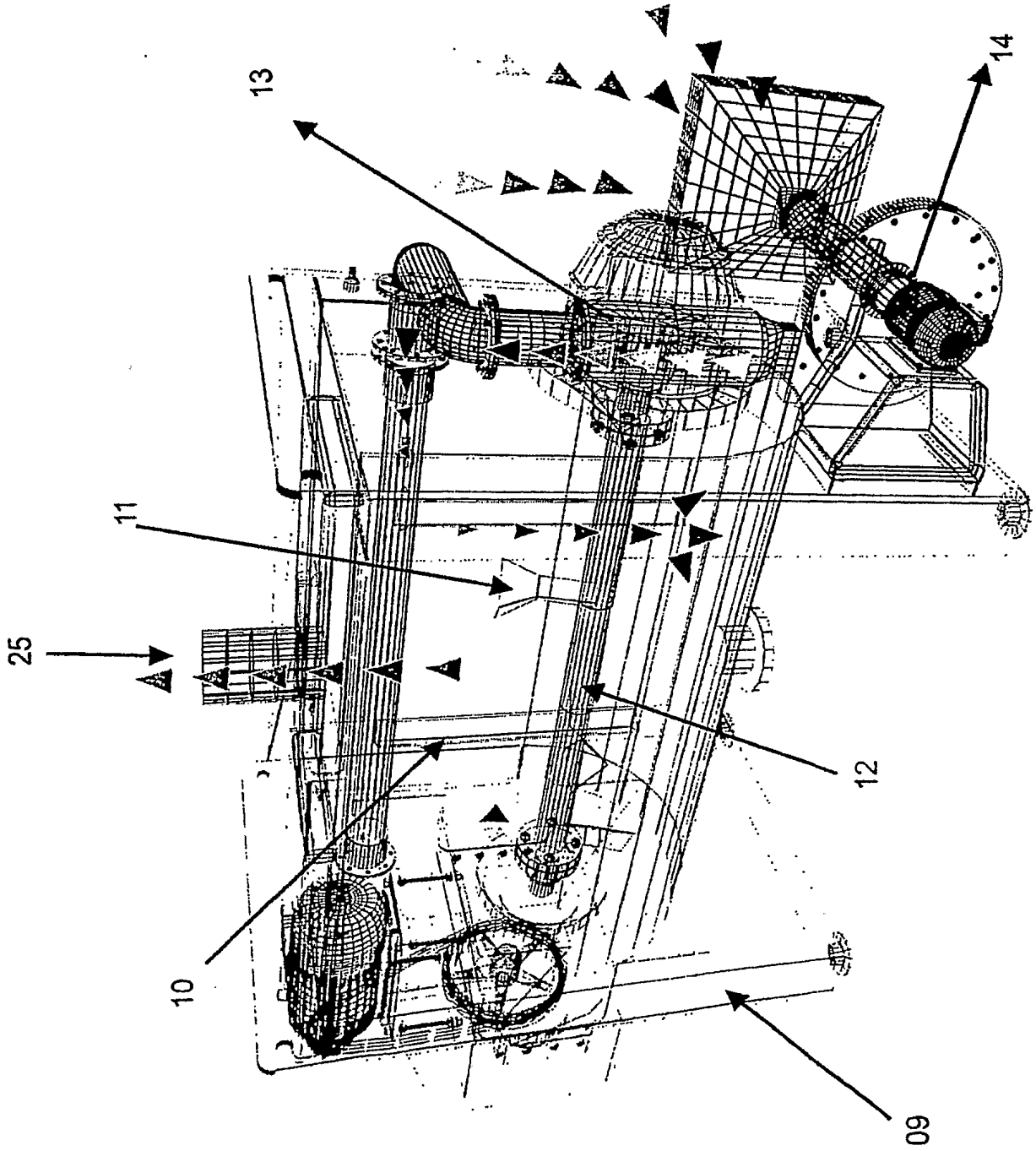

FIG. 3

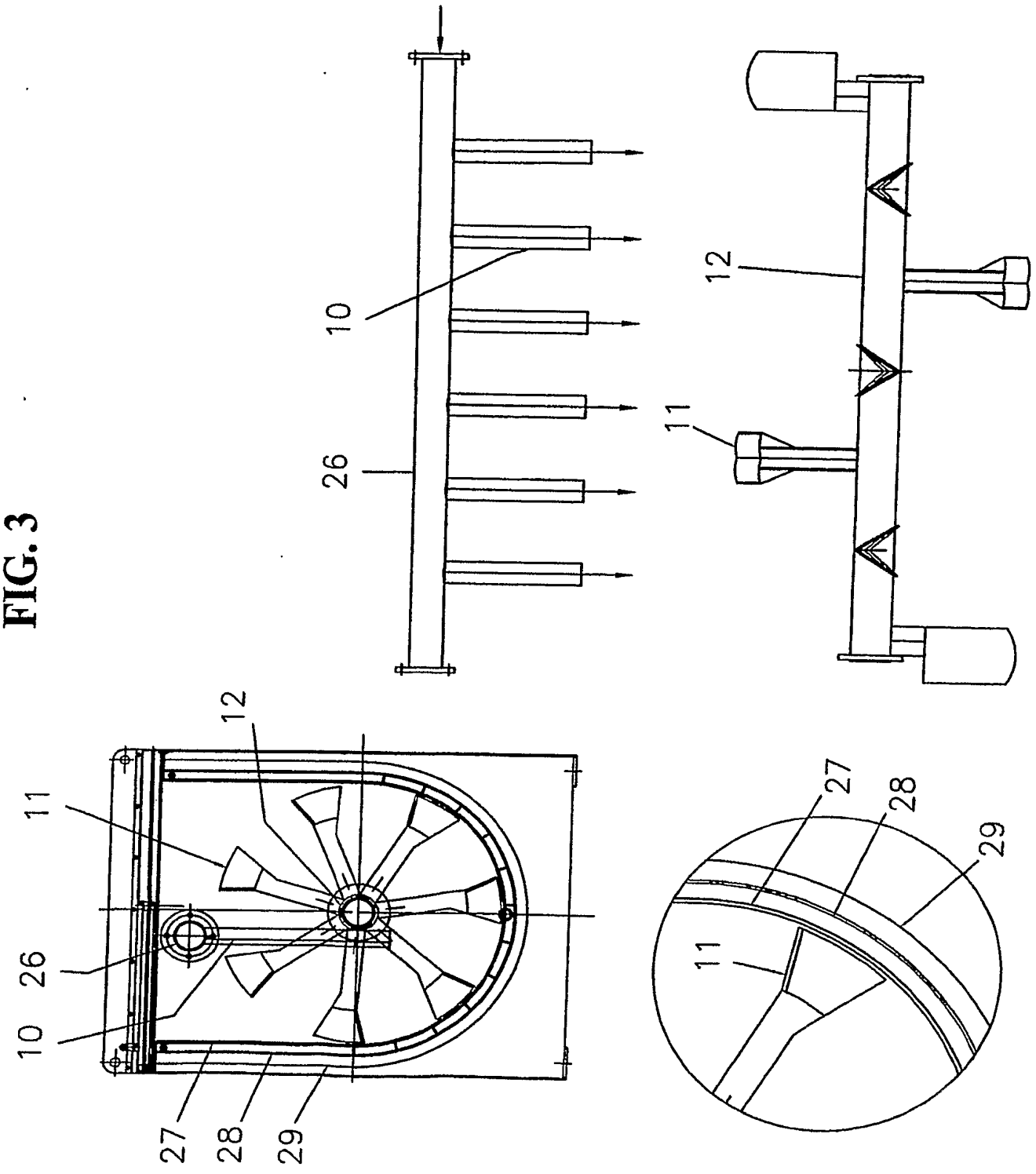

FIG. 4

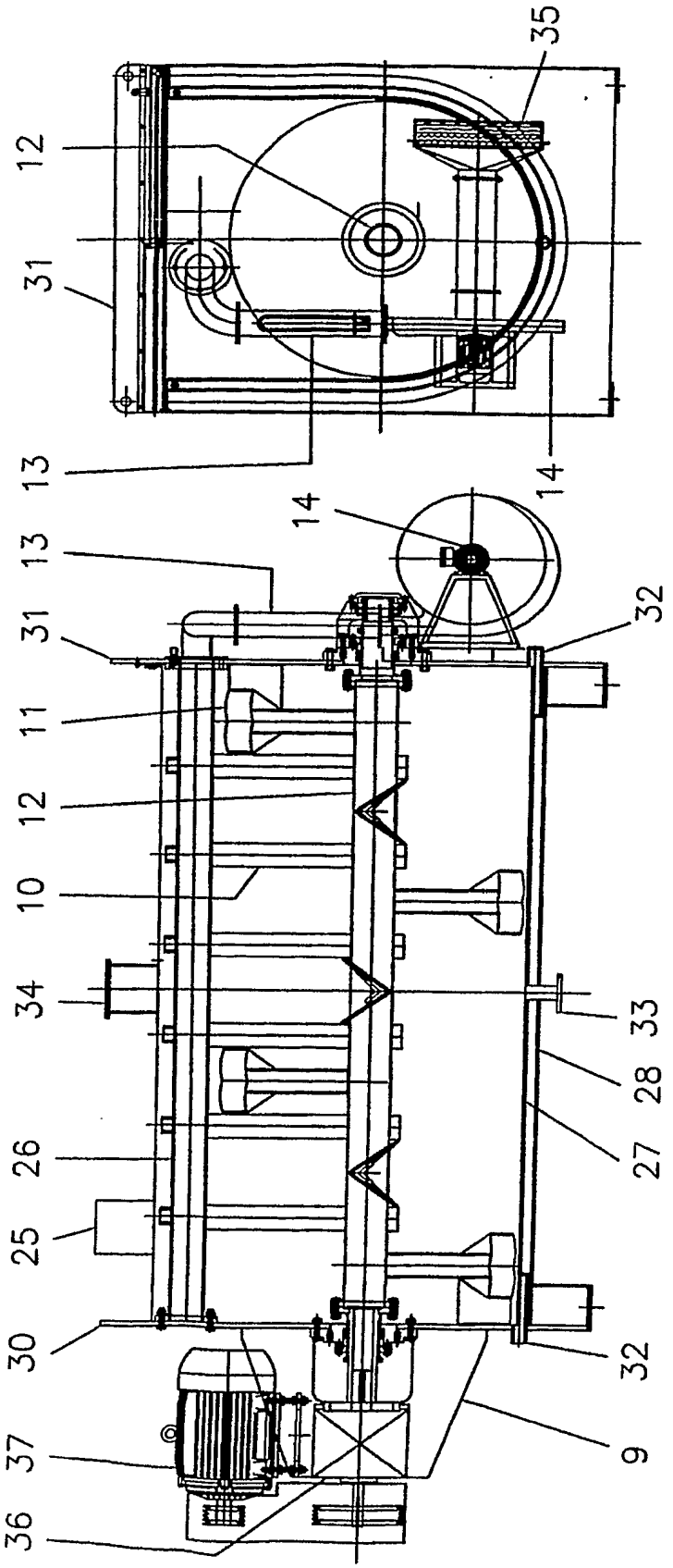

FIG. 5

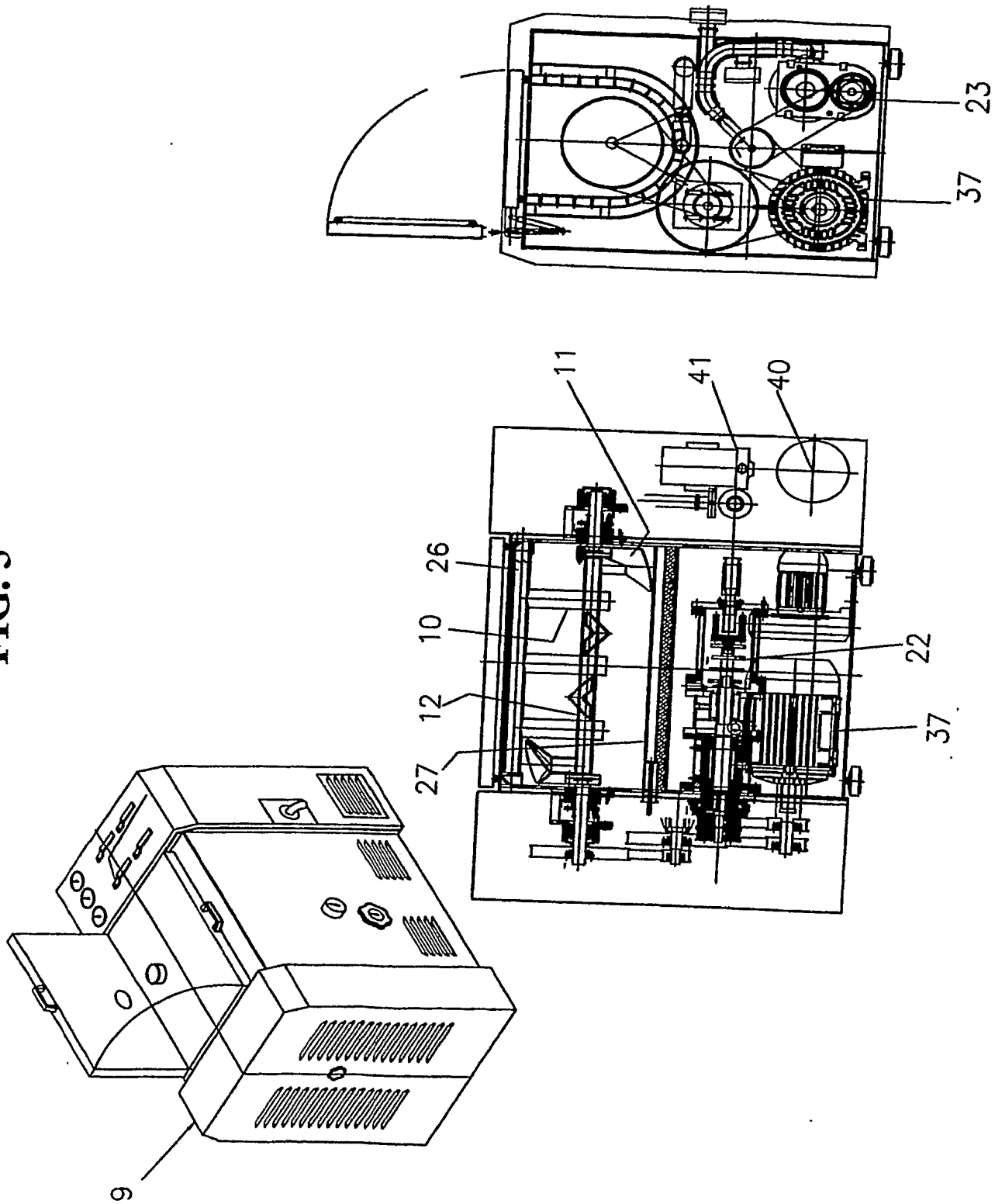

FIG. 6